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(57) Abstract	<p>A system and method for providing telephony and high speed data access over a broadband access network, comprising a network interface unit (NIU) coupled to a backup local exchange carrier (LEC) line, the broadband access network coupled to the NIU, an intermediate point-of-presence (IPoP) coupled to the broadband access network, and a least one external access network coupled to the IPoP. The system also provides for a fail-safe mode in which the NIU supports the LEC line for lifeline services.</p>	

INTERNATIONAL PATENT PRACTICE IN THE FIELD OF INVENTIONS

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A METHOD AND SYSTEM FOR TELEPHONY AND HIGH SPEED DATA ACCESS ON A BROADBAND ACCESS NETWORK

Priority Claim

We hereby claim the benefit under 35 U.S.C. § 119(e) of U.S. Provisional Application No. 60/071,346 filed January 14, 1998, entitled "Telephony On A Broadband Network."

Field of the Invention

This invention relates to the field of broadband access networks, and more specifically to a method and system for telephony and high speed data access on a broadband access network.

Background of the Invention

Broadband access networks may provide a viable alternative to present local exchange carrier (LEC) loops in providing voice and data transmissions. Although a number of innovations have occurred concerning high speed cable modems and radio frequency (RF) telephony equipment, these innovations do not support both data and telephony well. Furthermore, present broadband access networks such as cable systems are susceptible to network failures and power outages. During, for example, a power outage, transmission over the cable system is not possible. LEC loops have very limited bandwidths; however, the LEC loops have separate power sources and operate even during power outages providing for emergency calls or other lifeline services.

What is needed is an invention that supports data and telephony access over broadband access networks while still providing, at least, basic telephony service during power outages.

Summary of the Invention

The present invention provides for a system for providing telephony and high-speed data access over a broadband access network. The system includes a network interface unit (NIU) coupled to a telephone line, the NIU coupled also to the broadband access network, the broadband access network coupled to an intermediate point-of-presence (IPOP), and the IPOP coupled to at least one external access network.

The present invention also provides for a network interface unit (NIU) of a system for providing telephony and high speed data access on a cable network. The system includes a broadband telephone interface (BTI) coupled to a backup local exchange carrier

(LEC) line, and a cable modem coupled to the BTI. The cable modem is coupled to the cable network.

The present invention also provides for an office in a system for providing telephony and high speed data access on a cable network. The office includes a network interface unit (NIU) having a broadband telephone interface (BTI) and a cable modem. The office also includes a telephone line coupled to the BTI and a cable coupled to the cable modem.

The present invention provides for a network interface unit (NIU) in a system for providing telephony and high speed data access on a cable network. The NIU includes a cable modem and a means for accessing a telephone line during a power outage.

The present invention provides for an intermediate point-of-presence (IPOP) in a system for providing telephony and high speed data access on a broadband access network. The IPOP includes means for separating voice and data traffic, means for switching to an external access network, and means for routing to the external access network. The separating means is coupled to the switching means and the routing means is coupled to the switching means.

The present invention further provides for an intermediate point-of-presence (IPOP) in a system for providing telephony and high speed data access on a broadband access network. The IPOP includes an access network termination system (ANTS), a switch coupled to the ANTS, and at least one number translation database coupled to the switch.

The present invention provides for a method for providing telephony and high speed data access on a broadband access network. The method includes the steps of providing a network interface unit (NIU), coupling a telephone line and the broadband access network to the NIU, using the NIU to provide telephony and high speed data access on the broadband access network, and using the NIU to support the telephone line during power outages.

The present invention provides for a method for providing a network interface unit (NIU) in a system for providing telephony and high speed data access on a cable network. The method includes the steps of supporting a backup, local exchange carrier (LEC) line with a broadband telephone interface (BTI), using the backup LEC line during a failure of

the cable network, and accessing telephony and high speed data through a cable modem coupled to the cable network.

The present invention provides for a method for providing lifeline services during a power outage in a system for providing telephony and high speed data access on a broadband access network. The method includes the steps of connecting a backup local exchange carrier (LEC) line to the system and accessing the backup LEC line.

Brief Description of the Drawings

Figure 1 illustrates a system which provides telephony and high speed data access on a broadband access network. A FIGURE AND BRIEF DESCRIPTION OF THE DRAWINGS

Figure 2 illustrates an office in a system which provides telephony and high speed data access on a cable system.

Detailed Description

Figure 1 illustrates a system which provides telephony and high speed data access on a broadband access network in accordance with a preferred embodiment of the present invention. The system 100 comprises offices 104, network interface units (NIUs) 108, personal computers 112, telephones 116, a broadband access network 120, an intermediate point-of-presence (IPOP) 124, an access network termination system (ANTS) 128, a switch 132, at least one number translation database 136, at least one external access network 140 and a local exchange carrier (LEC) line 148.

Each office 104 comprises the NIU 108, the personal computer 112 and the telephone 116. The personal computer 112 is coupled to the NIU 108, the coupling being preferably through a local area network (LAN) such as, for example, an ethernet. As such, there may be a plurality of personal computers 112 coupled to the NIU. The telephone 116 is also coupled to the NIU. There may be more than one telephone 116 within the office 104 coupled to the NIU either directly or indirectly. Furthermore, the telephone 116 may include any variety of office equipment such as fax machines, voice grade modems, hand sets and internal housing wiring.

Each office 104 is coupled to the broadband access network 120 through its NIU 108. The broadband access network 120 is coupled to the IPOP 124. The broadband access network 120 in the system 100 is intended to accommodate a range of transport

technologies such as, but not limited to, hybrid-fiber coaxial cable, mini-fiber node and wireless technologies.

The IPOP 124 comprises the ANTS 128, the switch 132 and the at least one number translation database 136. The ANTS 128 is coupled to the switch 132 which, in turn, is coupled to the at least one number translation database 136. The ANTS 128 is coupled to the broadband access network 120. In a preferred embodiment, the at least one external access network 140 is coupled either to the ANTS 128 and/or to the switch 132. In a preferred embodiment, the at least one external access network 140 comprises a packet backbone 141 coupled to the ANTS 128. In another preferred embodiment, the at least one external access network 140 comprises an asynchronous transfer mode (ATM) backbone (not shown) coupled to the ANTS 128. In another preferred embodiment, the at least one external access network 140 comprises a long distance carrier network 142 coupled to the switch 132. In another preferred embodiment, the at least one external access network 140 comprises an LEC network 145 coupled to the switch 132. In another preferred embodiment, the at least one external access network 140 comprises an incumbent local exchange carrier (ILEC) network 144 coupled to the switch 132. In another preferred embodiment, the at least one external access network 140 comprises an inter-exchange carrier (IXC) network 143 coupled to the switch 132. In another preferred embodiment, the at least one external access network 140 comprises the ATM backbone (not shown) coupled to the switch 132. The present invention contemplates any permutations and combinations of the above possible external access networks 140 and possible couplings to the IPOP 124.

In a preferred embodiment, the LEC line 148 couples the NIU 108 and the LEC network 145.

The general use and operation of the system 100 will now be described with reference to Figure 1. A user accesses the broadband access network 120 by using existing personal computers 112 or telephones 116 in the office 104. The voice and/or high speed data traffic transferred or received by these devices 112 and 116 passes through the NIU 108. The NIU 108 terminates the data-link layer protocol from the broadband access network 120 and provides services for voice, high speed data and any combination thereof.

High speed data and telephony services share allocated bandwidth in the downstream direction as well as in the frequency agile upstream channel.

A remote data-link layer termination is performed at the IPOP 124 by the ANTS 128. Voice and high speed data traffic flowing to and from the offices 104 pass through the ANTS 128. Upstream voice and high speed data traffic are separated or groomed by the ANTS 128, if necessary, before being forwarded onwards. In a preferred embodiment, upstream voice traffic may be processed within the ANTS 128 which connects the voice to a circuit switched public switched telephone network (PSTN). Upstream data may be processed within the ANTS 128 before being handed to a router. In another preferred embodiment, upstream voice traffic is separated and routed to, for example, the packet backbone 141. Voice traffic is separated and routed to, for example, the local exchange switch 132. In another preferred embodiment, the ANTS 128 interfaces to the local switch 132 like a conventional subscriber loop carrier (SLC) system.

The system 100 acts as an LEC, providing voice service over the broadband access network 120. Calls originating from office 104 may be routed to the long distance network 142, the IXC network 143, the ILEC network 144 or the LEC network 145. Incoming long distance calls are routed to the LEC that serves the local number using the local number portability database. Several number translation databases 136 are typically needed in order to manage call routing.

If communication to the IPOP 124 over the broadband access network 120 is not possible, lifeline services are provided through an LEC line 148 connected to the NIU 108.

Figure 2 illustrates an office in a system which provides telephony and high speed data access on a cable system in accordance with another preferred embodiment of the present invention. The office 104 houses the NIU 108, the personal computer 112, the telephone 116, a local area network (LAN) 212 and a television 216. The NIU 108 further comprises a broadband telephone interface (BTI) 204 coupled to a cable modem 208.

The office 104 is coupled to the LEC line 148 and the broadband access network 120, which is illustrated in this preferred embodiment as a cable network. The LEC line 148 is coupled to the BTI 204 which is coupled to the telephone 116. The telephone 116 may be one of many telephones in an internal telephone network and may also be legacy equipment such as, but not limited to, fax machines, voice grade modems, hand sets and

internal housing wiring. The BTI 204 may have a plurality of standard RJ-11 jacks to support a plurality of lines of telephony service.

The cable network 120 is coupled to the cable modem 208 which is coupled to the LAN 212 which is coupled to the personal computer 112. The LAN 212 may be an ethernet, for example, and the personal computer 112 may be a plurality of personal computers coupled to the ethernet. The cable 120 is also coupled to the television 216.

In operation and use, the personal computers 112 through an ethernet 212 access high speed data ports in the cable modem 208. Through the cable modem 208, the ethernet 212 is provided, for example, internet services on the cable network 120. The television 216 accesses voice, high speed data and combinations thereof directly from the cable network 120.

In a preferred embodiment, the BTI 208 provides custom telephony services including, but not limited to, caller-identification, call waiting, tone block, return call, repeat call, call block, call forwarding, call forwarding on busy, call forwarding when no answer, anonymous call rejection, identa-ring, priority call, three-way calling and blocking. Furthermore, a wide ranging list of destinations may be dialed including, but not limited to, local calls, directory assistance, emergency calls, recorded announcements, domestic long distance calls, carrier-selected long distance calls, toll-free calls, operator services, international calls, and so-called 500/700/900 calls.

The BTI 204 supports voice packetization and a dynamic fail-safe switch to the LEC backup line 148. For the telephone ports, in the upstream direction, the BTI 204 samples the signal, performs speech compression, and performs packetization. The cable modem 208 places the packets on the cable network 120. In the downstream direction, the BTI 204 receives packets from the cable network 120 through the cable modem 208, performs jitter compensation in a playout buffer, performs decompression and plays out the samples. The BTI 204 is also responsible for dual tone multi-frequency (DTMF) generation and detection, ringing voltage generation and off-hook detection.

Transmission on the cable network 120 requires power. During power outages, the LEC line 148 is used to complete inbound and outbound telephone calls. In a preferred embodiment, the transition from the cable network 120 to the LEC line 148 is performed automatically and transparently with almost imperceptible performance differences. In

some embodiments, calls in progress at the time of a power loss are dropped, and the user must redial. In other embodiments, custom calling features are not available during power outages. In another embodiment, the BTI 204 provides, for example, all PSTN features and functions, except during the fail-safe mode. In the fail-safe mode of another embodiment, the LEG backup line 148 provides basic plain old telephone service (POTS).

In a preferred embodiment, the NIU 108 provides the architecture for a migration plan by accommodating future networks by providing compatibility with the ATM backbone as well as adaptability to any new features and functions that may arise.

10 Although the foregoing invention has been described in terms of certain embodiments, other embodiments will become apparent to those of ordinary skill in the art in view of the disclosure herein. Accordingly, the present invention is not intended to be limited by the recitation of embodiments; but is intended to be defined solely by reference to the appended claims.

the \mathcal{L}^2 norm of the difference between the true and estimated \mathbf{A} is 0.0001, and the \mathcal{L}^2 norm of the difference between the true and estimated \mathbf{B} is 0.0002.

WHAT IS CLAIMED IS:

1. A system for providing telephony and high-speed data access over a broadband access network, comprising:
 - a network interface unit (NIU) coupled to a telephone line;
 - the broadband access network coupled to the NIU;
 - an intermediate point-of-presence (IPOP) coupled to the broadband access network; and
 - at least one external access network coupled to the IPOP.
2. The system of Claim 1, wherein the NIU comprises a broadband telephone interface (BTI), the BTI coupled to the telephone line.
3. The system of Claim 1, wherein the NIU comprises a cable modem and wherein the broadband access network is a hybrid-fiber coaxial cable, the cable modem coupled to the hybrid-fiber coaxial cable.
4. The system of Claim 1, wherein the IPOP comprises an access network termination system (ANTS) coupled to a switch, the ANTS coupled to the broadband access network.
5. The system of Claim 4, wherein the at least one external access network comprises a packet backbone coupled to the ANTS.
6. The system of Claim 4, wherein the at least one external access network comprises a long distance network, the long distance network coupled to the switch.
7. The system of Claim 4, wherein the at least one external access network comprises an inter-exchange net (IXC) network, the IXC network coupled to the switch.
8. The system of Claim 4, wherein the at least one external access network comprises a local exchange carrier (LEC) network, the LEC network coupled to the switch.
9. The system of Claim 4, wherein the at least one external access network comprises an incumbent local exchange carrier (ILEC) network, the ILEC network coupled to the switch.
10. The system of Claim 4, wherein the at least one external access network comprises an asynchronous transfer mode (ATM) backbone, the ATM backbone coupled to the switch.

11. The system of Claim 4, wherein the IPOP further comprises at least one number translation database, the at least one number translation database coupled to the switch.
12. The system of Claim 1, wherein the broadband access network is a wireless network.
13. The system of Claim 4, wherein the at least one external access network comprises an asynchronous transfer mode (ATM) backbone.
14. A network interface unit (NIU) of a system for providing telephony and high speed data access on a cable network, comprising:
 - a broadband telephone interface (BTI) coupled to a backup local exchange carrier (LEC) line; and
 - a cable modem coupled to the BTI, the cable modem coupled to the cable network.
15. An office in a system for providing telephony and high speed data access on a cable network, comprising:
 - a network interface unit (NIU) including a broadband telephone interface (BTI) and a cable modem; the network interface unit further comprising:
 - a telephone line coupled to the BTI; and
 - a cable coupled to the cable modem.
16. The office of Claim 15, wherein the BTI has at least one RJ-11 jack.
17. The office of Claim 15, further comprising at least one telephone coupled to the BTI.
18. The office of Claim 15, further comprising legacy equipment in the office, the legacy equipment coupled to the BTI.
19. The office of Claim 15, further comprising an ethernet and a personal computer, the personal computer coupled to the cable modem through the ethernet.
20. The office of Claim 15, further comprising a television coupled to the cable.
21. The office of Claim 15, further comprising a monitor coupled to the cable.
22. The office of Claim 15, wherein the cable is a hybrid-fiber coaxial cable.
23. A network interface unit (NIU) in a system for providing telephony and high speed data access on a cable network, comprising:

a cable modem; and

a means for accessing a telephone line during a power outage.

24. An intermediate point-of-presence (IPOP) in a system for providing telephony and high speed data access on a broadband access network, comprising:

means for separating voice and data traffic;

means for switching to an external access network, the separating means coupled to the switching means; and

means for routing to the external access network, the routing means coupled to the switching means.

25. An intermediate point-of-presence (IPOP) in a system for providing telephony and high speed data access on a broadband access network, comprising:

an access network termination system (ANTS);

a switch coupled to the ANTS; and

at least one number translation database coupled to the switch.

26. A method for providing telephony and high speed data access on a broadband access network, comprising the steps of:

providing a network interface unit (NIU);

coupling a telephone line and the broadband access network to the NIU;

using the NIU to provide telephony and high speed data access on the broadband access network; and

using the NIU to support the telephone line during power outages.

27. A method for providing a network interface unit (NIU) in a system for providing telephony and high speed data access on a cable network, comprising the steps of:

supporting a backup, local exchange carrier (LEC) line with a broadband telephone interface (BTI);

using the backup LEC line during a failure of the cable network; and

accessing telephony and high speed data through a cable modem coupled to the cable network.

28. A method for providing lifeline services during a power outage in a system for providing telephony and high speed data access on a broadband access network, comprising the steps of:

connecting a backup local exchange carrier (LEC) line to the system; and
accessing the backup LEC line.

29. A system for providing lifeline services during a power outage in a system for providing telephony and high speed data access on a broadband access network, comprising:

means for connecting a backup local exchange carrier (LEC) line to the system; and

means for accessing the backup LEC line.

30. A system for providing lifeline services during a power outage in a system for providing telephony and high speed data access on a broadband access network, comprising:

means for connecting a backup local exchange carrier (LEC) line to the system; and

means for accessing the backup LEC line.

31. A system for providing lifeline services during a power outage in a system for providing telephony and high speed data access on a broadband access network, comprising:

means for connecting a backup local exchange carrier (LEC) line to the system; and

means for accessing the backup LEC line.

32. A system for providing lifeline services during a power outage in a system for providing telephony and high speed data access on a broadband access network, comprising:

means for connecting a backup local exchange carrier (LEC) line to the system; and

means for accessing the backup LEC line.

33. A system for providing lifeline services during a power outage in a system for providing telephony and high speed data access on a broadband access network, comprising:

means for connecting a backup local exchange carrier (LEC) line to the system; and

means for accessing the backup LEC line.

34. A system for providing lifeline services during a power outage in a system for providing telephony and high speed data access on a broadband access network, comprising:

means for connecting a backup local exchange carrier (LEC) line to the system; and

means for accessing the backup LEC line.

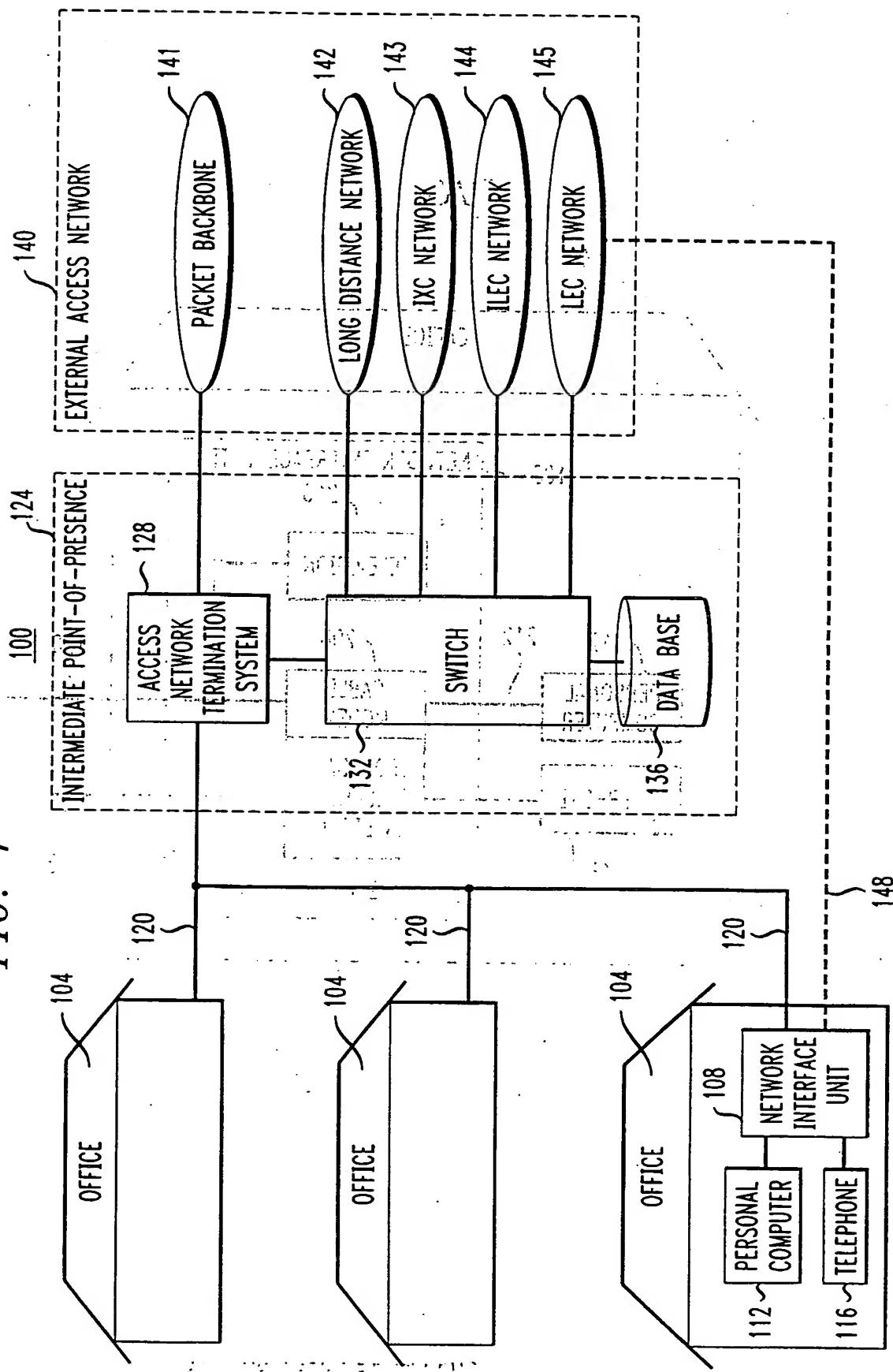
35. A system for providing lifeline services during a power outage in a system for providing telephony and high speed data access on a broadband access network, comprising:

means for connecting a backup local exchange carrier (LEC) line to the system; and

means for accessing the backup LEC line.

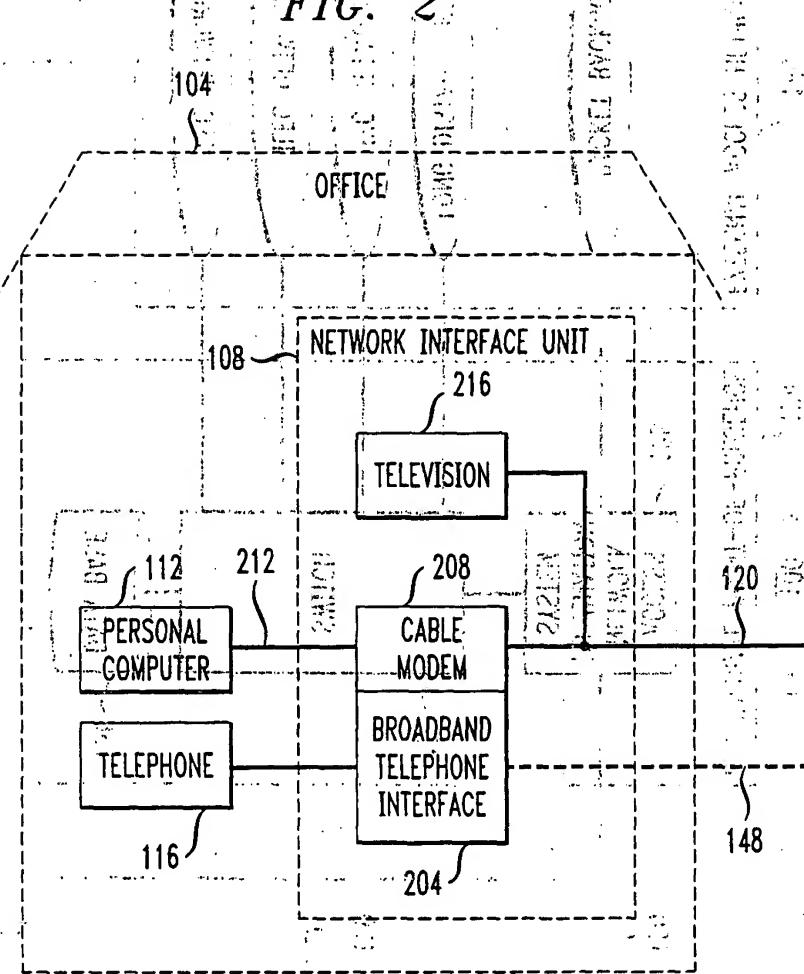
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FIG. 1



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FIG. 2



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INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 99/00175

A. CLASSIFICATION OF SUBJECT MATTER

IPC 6 H04L12/28 H04L29/06 H04Q11/04

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 H04L H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	HERNANDEZ-VALENCIA E-J: "ARCHITECTURES FOR BROADBAND RESIDENTIAL IP SERVICES OVER CATV NETWORKS" IEEE NETWORK: THE MAGAZINE OF COMPUTER AND COMMUNICATIONS, vol. 11, no. 1, 1 January 1997, pages 36-43, XP000679054 see page 36, left-hand column, line 1 - page 41, right-hand column, line 19	1-3, 14, 15, 22, 23
Y	-----	4-13, 16-21, 25-28
A	-----	24

Further documents are listed in the continuation of box C.

Patent family members are listed in annex.

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INTERNATIONAL SEARCH REPORT

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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